

Repair: Power Supply Assembly

The power supply assembly is a modular unit that supplies various voltages to the ventilator electronic system. The power supply assembly consists of a +5 V module, a +12 V module, a ± 15 V module, and a power fail module. These modules are individually replaceable. In addition, depending on ventilator model, the power supply is augmented by a surge suppressor mounted above the power supply, and/or by a power line filter mounted in the utility panel. An isolation transformer is installed in later ventilator versions to step the voltage to the power fail module.

This section describes removal, installation, testing, and adjustment of the power supply assembly and its components. Before repairing the power supply assembly, familiarize yourself with the warnings, cautions, and general repair instructions in Section 8.

Warning

- To prevent personal injury and equipment or property damage, ensure that electrical power sources and pneumatic sources are disconnected from the ventilator before servicing.
 - If ventilator must be serviced with the power on, be careful to avoid electrical shock. Avoid reaching into the ventilator. Follow accepted safety procedures for electrical equipment when testing, making connections, adjustments, or repairs.
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11.1 Testing Output Voltages

The power supply voltages may be tested without accessing the power supply. To test these voltages, refer to Section 7.6.7 (performance verification).

11.2 Calibration of Output Voltages

1. Calibrate the power supply output voltages as follows, referring to Figure 11-1.
2. Connect ventilator to electrical power. Turn on ventilator power.
3. Calibrate power supply module output voltages by connecting insulated .025 in. square pin DMM leads to appropriate pins on the motherboard connector J14 as indicated in Figure 11-1, then adjusting appropriate potentiometer until DMM reads within acceptable range. Seal potentiometer with torque seal when adjustment is successful.

NOTE:

If adjustment of the applicable potentiometer fails to bring a voltage into its acceptable range, replace the module or power supply assembly, as appropriate.

4. Turn off power to ventilator. Unplug ventilator power cord.

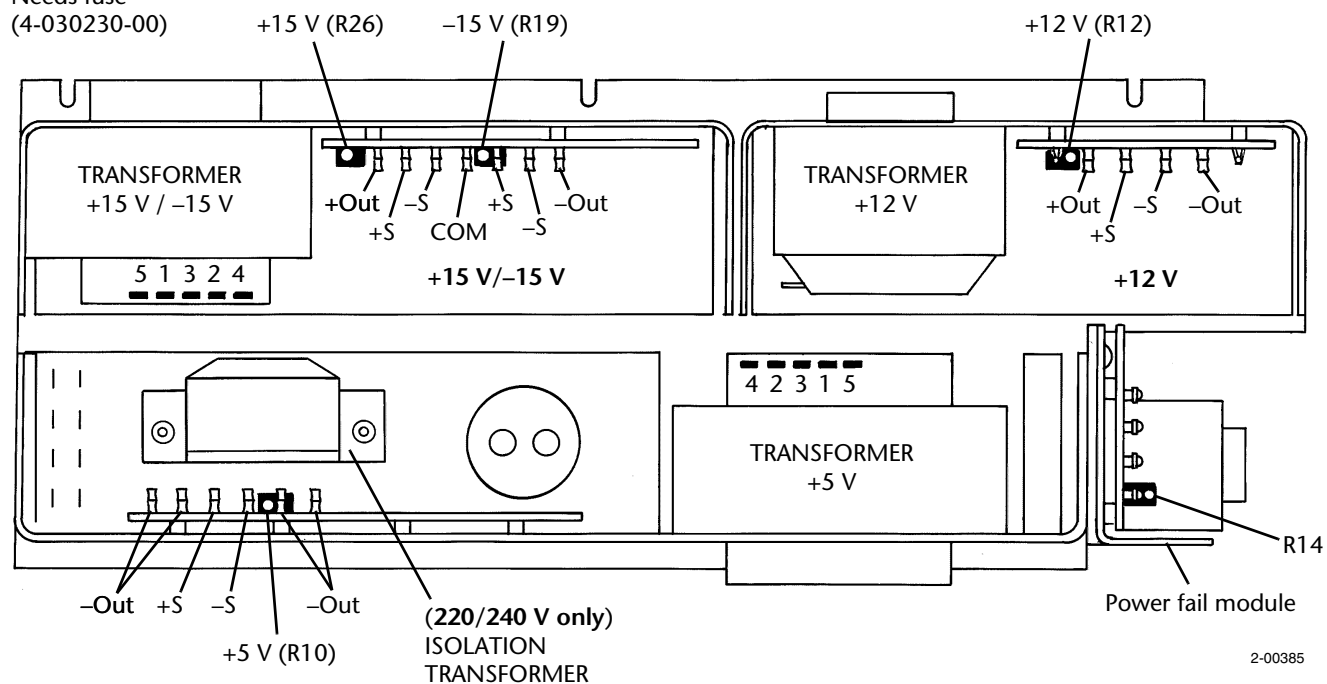
Power Supply Voltages

Voltage to be Measured	Potentiometer	Positive Lead	Negative Lead	Acceptable Range
+5 V	R10	Pin 9	Pin 11	+4.95 to +5.05 V
+12 V	R12	Pin 13	Pin 11	+11.88 to +12.12 V
+15 V	R26	Pin 7	Pin 5	+14.85 to +15.15 V
-15 V	R19	Pin 4	Pin 5	-15.15 to -14.85 V

(EMI 7200ae only)

Needs fuse

(4-030230-00)



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Power Fail Trip Points

Ventilator Voltage	Power Fail Trip Point	POST Value
100 V ac	82 ± 1 V ac	90 V ac
115 V ac	95 ± 1 V ac	103.5 V ac
220 V ac	186 ± 1 V ac	198 V ac
240 V ac	204 ± 1 V ac	216 V ac

Figure 11-1. Power Supply Voltage and Trip Point Calibration

11.3 Calibration of Power Fail Trip Point

The power fail module monitors the input power to the power supply assembly. If the input power drops below the power fail trip point for 4 ms to 6 ms, the power fail module generates a power fail signal, which signals the CPU.

Calibrate the trip point of the power fail module as follows. The calibration requires a variable transformer (variac) with ground wire. A 0-140 V, 10 A variac is required for 100 and 115 V ventilators, while a 0-280 V, 5 A variac is required for 220 and 240 V units.

NOTE:

Care must be taken when performing this procedure. When adjusting the variac voltage, use a slow and steady motion to avoid lowering the voltage below the actual power fail trip point, thereby invalidating the results.

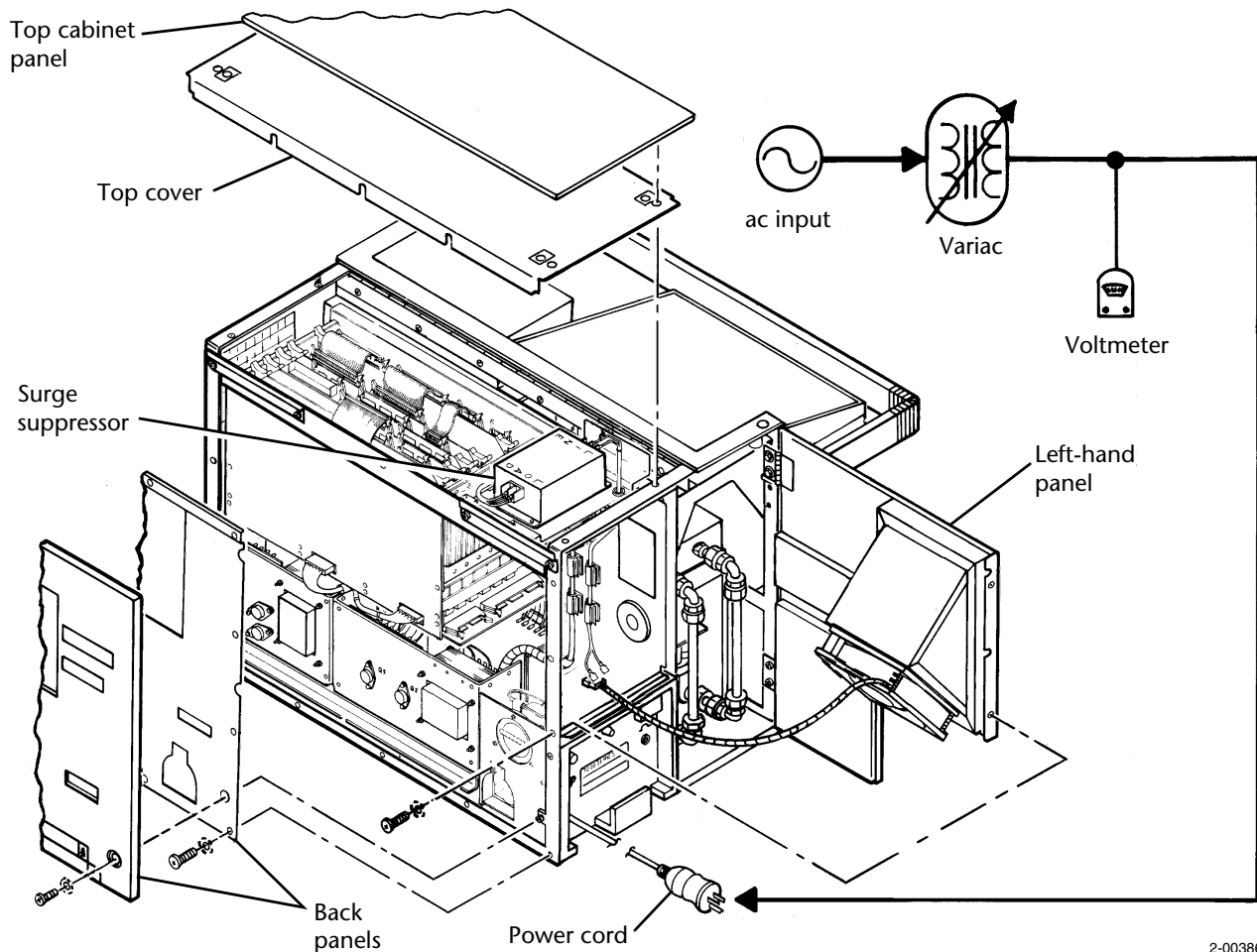
1. Remove ventilator top and back panels (Sections 19.1 through 19.4), and swing open left-hand panel (Section 9.1, steps 2 through 4). Disconnect all accessories (ac and dc powered) from ventilator.
2. Connect electrical source to variac and connect variac to ventilator, as shown in Figure 11-2.
3. Adjust output of variac to applicable voltage (100, 115, 220, or 240 V).
4. Switch on ventilator power.
5. Connect DMM leads to a convenient location outside the ventilator in order to monitor the input voltage, but place the leads as close to the ventilator's power cord as possible. Note the DMM voltage reading.
6. Remove DMM leads and place them on the "LINE" side of the surge suppressor, or on the #2 tabs of the utility panel terminal block (if the unit is not equipped with a surge suppressor). Note the DMM reading and compare it to the original reading. If the two readings differ by more than 2 V, inspect terminal block, power cord, relay, and circuit breaker for signs of oxidation. Clean or replace as necessary to correct.
7. While monitoring input voltage, slowly adjust variac to reduce input voltage until LEDs on CPU PCB begin to flash. The point where CPU PCB LEDs begin to flash is the power fail trip point. Verify that the DMM reading is within the applicable power fail trip point range in Figure 11-1.
8. Raise variac voltage to where Power-On-Self-Test (POST) is initiated. Verify that the DMM reading is less than or equal to the POST value given in Figure 11-1.
9. Repeat step 7 to verify power fail trip point.
10. Readjust output of variac to applicable voltage (100, 115, 220, or 240 V).

NOTE:

To avoid damaging the power fail trip point adjustment potentiometer (R14), use extreme care when scraping off the existing torque seal.

11. If necessary, use a long, insulated, flat-bladed screwdriver to adjust power fail trip point voltage by slowly turning the adjustment potentiometer (R14).
12. Repeat steps 7 through 11 until trip point and POST voltages are acceptable.
13. Seal potentiometer (R14) with torque seal (P/N 4-004017-00).
14. Turn off power switch to ventilator.
15. Disconnect ventilator and variac from wall power.

16. Reattach all panels (Section 19), hardware, and accessories (Section 3) to the ventilator.
17. Connect external pneumatic and electrical sources to ventilator.
18. Refer to performance verification procedures in Section 7 to verify that ventilator is operational.



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Figure 11-2. Power Fail Trip Point Calibration Test Setup

11.4 Removal/Installation of Top-Mounted Surge Suppressor

A surge suppressor filters voltage spikes. In those ventilators with a surge suppressor, the 100/115 V suppressor is always mounted near the top of the ventilator, while the 220/240 V suppressor may be mounted near the top or it may be integral to the utility panel. The following subsections discuss the service of top-mounted surge suppressors. Refer to Section 12.8 to service the 220/240 V surge suppressor integral to the utility panel.

11.4.1 100/115 V Surge Suppressor

Remove the 100/115 V surge suppressor as follows. Install by reversing removal procedures.

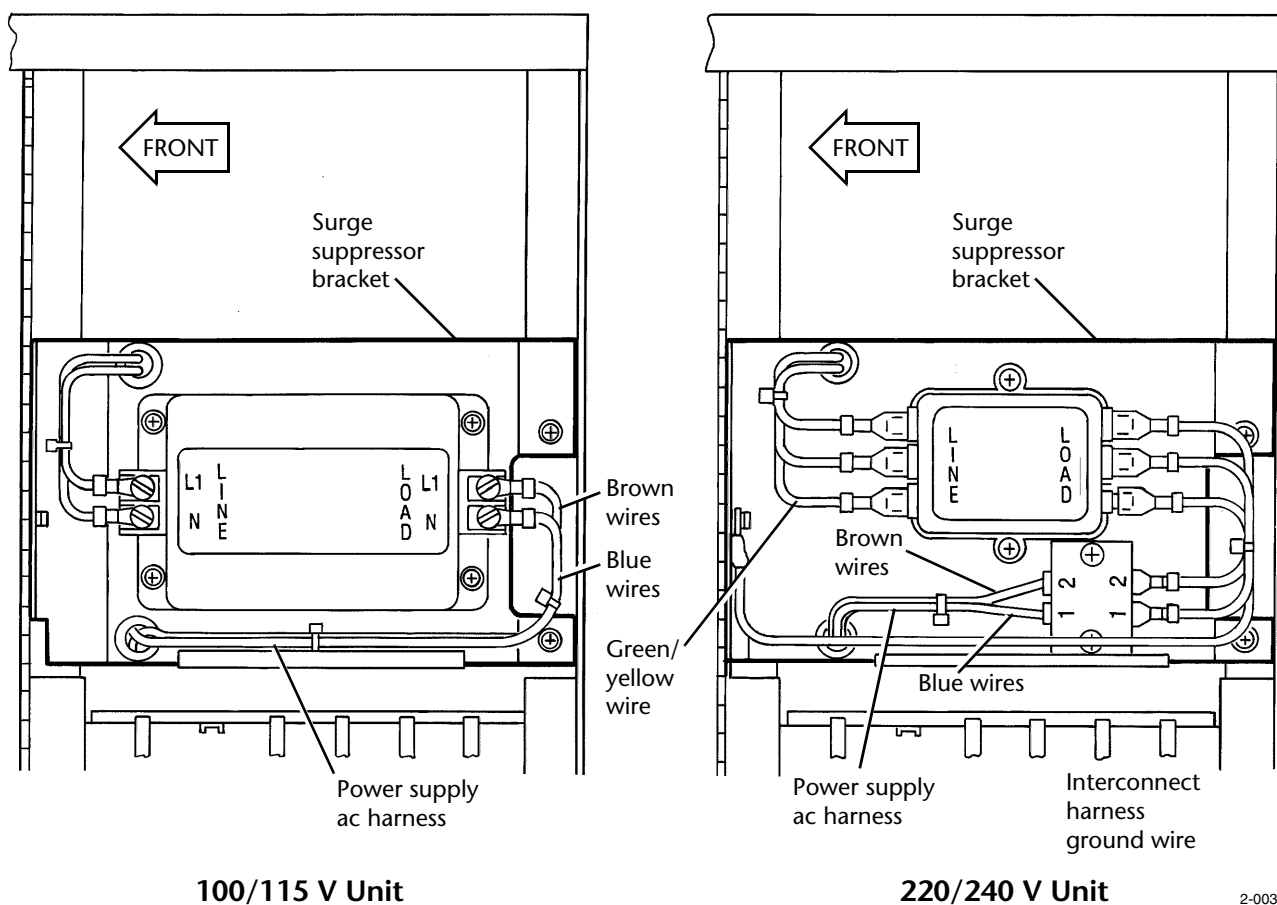
1. Remove ventilator top and back panels (Sections 19.1 through 19.4), and swing open left-hand panel (Section 9.1, steps 2 through 4).
2. Disconnect wires that are attached to the surge suppressor "LOAD" terminals from interconnect harness (if present) or from the surge suppressor (blue wires from "N", brown wires from "L1").

3. Pull power supply ac harness down through bottom of surge suppressor bracket. (Note that harness grommet is removable through slot in the edge of the bracket.)
4. Disconnect the following wires from utility panel terminal block (Figure 11-4):
 - a. Blue wire in surge suppressor harness from "N1" terminal.
 - b. Brown wire in surge suppressor harness from "L2" terminal.

NOTE:

The locations of utility panel terminals are shown on the terminal block label on the ventilator cabinet divider wall.

5. Remove harness from wire clips on ventilator cabinet divider wall, and pull harness up through bottom of surge suppressor bracket.
6. Remove screw and lock washer that attach front portion of surge suppressor bracket to ventilator console hinge panel.
7. Loosen two screws (one on either side of surge suppressor assembly) that attach two suppressor bracket clamps to surge suppressor bracket (Figure 11-5).
8. Remove surge suppressor by lifting its front edge and sliding clamps off rear ventilator cabinet lip.



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Figure 11-3. Disconnecting Top-Mounted Surge Suppressor Harness

11.4.2 220/240 V Surge Suppressor

If the 220/240 V surge suppressor is mounted near the top of the ventilator, remove it as follows. Install by reversing removal procedures.

1. Remove ventilator top and back panels (Sections 19.1 through 19.4), and swing open left-hand panel (Section 9.1, steps 2 through 4).
2. Disconnect wires that are attached to surge suppressor "LOAD" terminals from interconnect harness (if present) or from surge suppressor (blue wires from "N", brown wires from "L1").
3. Pull surge suppressor harness up through bottom of surge suppressor bracket. (Note that harness grommet is removable through slot in the edge of the bracket.)
4. Disconnect these wires from utility panel terminal block (Figure 11-4):
5. Blue wire in surge suppressor harness from "N1" terminal.
6. Brown wire in surge suppressor harness from "L2" terminal.
7. Disconnect green/yellow wire from green/yellow power cord ground wire (Figure 11-3).
8. Pull harness up through bottom of surge suppressor bracket.
9. Remove screw and washer that attach front portion of surge suppressor and interconnect harness ground wire to ventilator console hinge panel (Figure 11-5).
10. Remove surge suppressor by lifting its front edge and sliding clamps off rear ventilator cabinet lip.

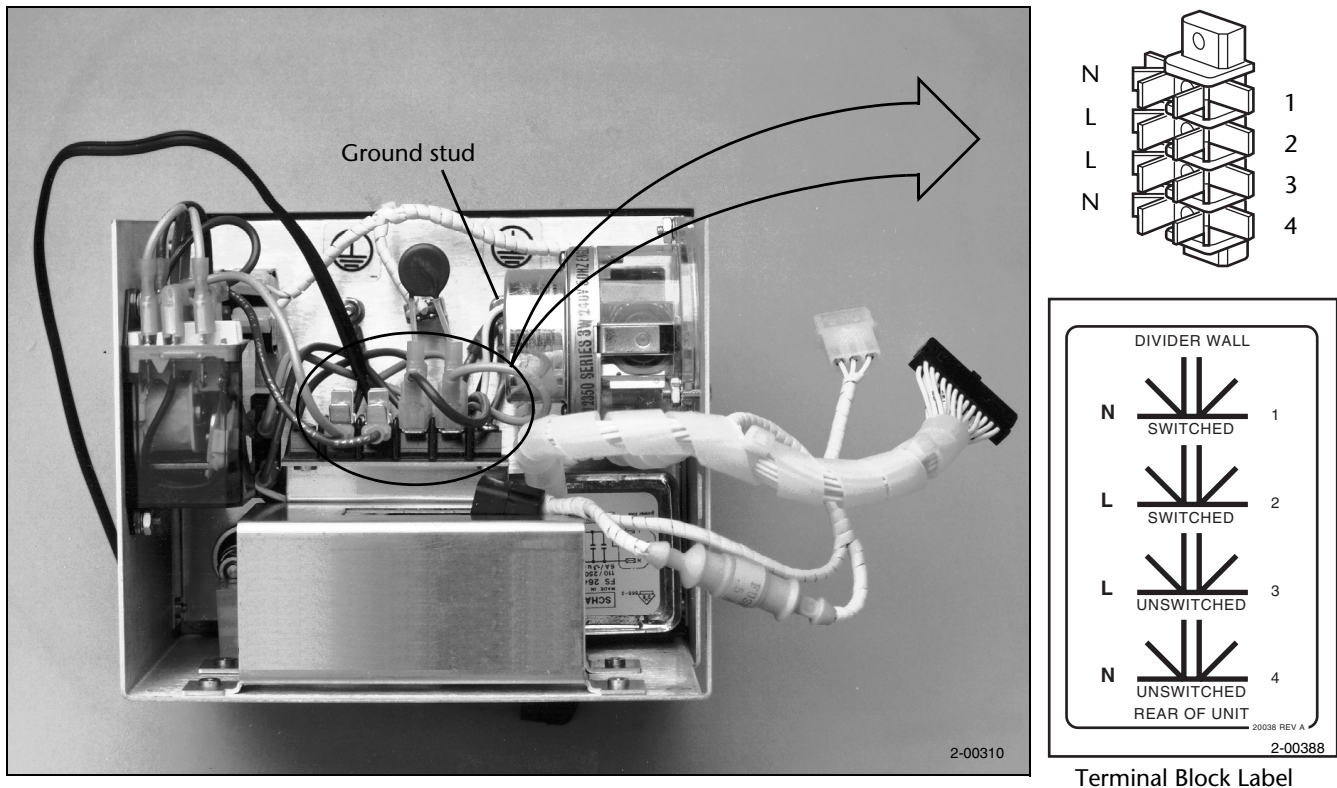


Figure 11-4. Disconnecting Harnesses from Utility Panel Terminal Block

11.5 Removal/Installation of Power Supply Assembly

Remove the power supply assembly from the ventilator as follows. Install by reversing removal procedures.

1. Disconnect power supply ac harness as applicable, depending on configuration:
 - From utility panel terminal block (blue wires) from “N1”, brown wire(s) from “L2” as in Figure 11-4.
 - From interconnect harness.
 - From surge suppressor terminal block

NOTE:

The locations of utility panel terminals are shown on the terminal block label on the ventilator cabinet divider wall.

2. Remove three screws and washers that attach rear bottom edge of power supply to ventilator (Figure 11-5).

Warning

The power supply assembly is very heavy. Be careful when lifting the power supply assembly out of the ventilator.

3. Remove the screws to the utility panel and slide it to the left side of the ventilator.

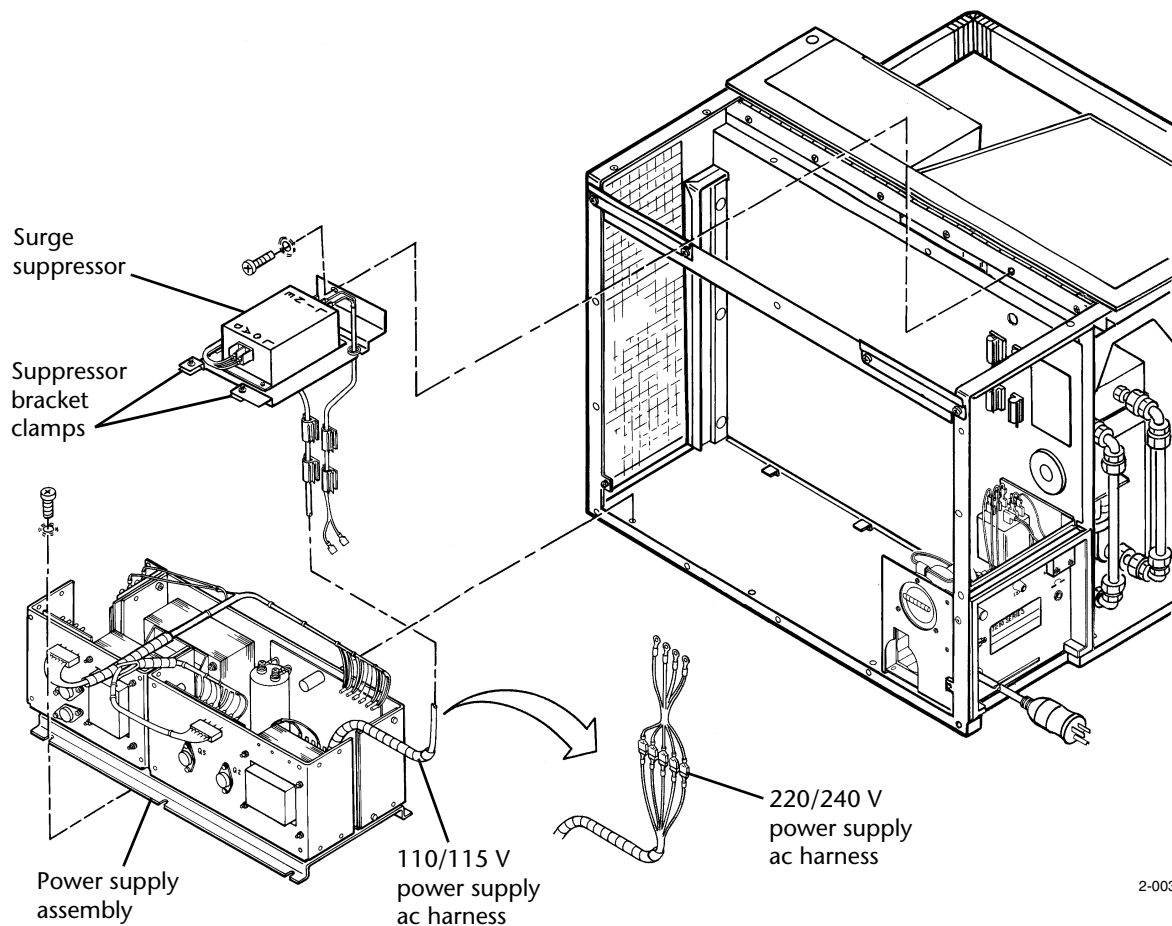


Figure 11-5. Removing Power Supply Assembly and Top-Mounted External Surge Suppressor

4. Slide power supply assembly towards rear of ventilator to disengage front bottom edge from three retaining clips.
5. Carefully remove power supply assembly by sliding it to the left side of the ventilator and removing it out the rear.

11.6 Removal/Installation of Power Supply Modules and Isolation Transformer

Three removable power supply modules are mounted to the power supply assembly baseplate. One of these modules, the +5 V module, has three removable components: a fuse plate, a power failure module, and an isolation transformer.

NOTE:

When installing power supply modules to baseplate, be sure nonconductive heatsink compound (P/N 4-004434-00) between baseplate and power modules is semi-sticky and free of debris and large area voids.

11.6.1 +5 V Module

Remove the +5 V module from the power supply assembly as follows, referring to Figure 11-6. Install by reversing removal procedures.

1. Remove power supply assembly from ventilator (Section 11.5).
2. Separate fuse plate from +5 V module by removing two screws and lockwashers.
3. Separate mounting plate and power fail module from +5 V module by removing two nuts and lockwashers.
4. Label and unsolder blue and brown wires of power supply ac harness from +5 V module transformer.
5. Label and unsolder power supply dc harness from +5 V module circuit board.
6. Separate +5 V module from baseplate by removing four attaching screws.
7. If removal of power fail module or isolation transformer is required, refer to Section 11.6.4 or 11.6.5, as applicable.

11.6.2 +12 V Module

Remove the +12 V module from the power supply assembly as follows, referring to Figure 11-6. Install by reversing removal procedures.

1. Remove power supply assembly from ventilator (Section 11.5).
2. Label and unsolder blue and brown wires of power supply ac harness from +12 V module transformer.
3. Label and unsolder power supply dc harness from +12 V module circuit board.
4. Separate +12 V module from baseplate by removing four attaching screws.

11.6.3 ± 15 V Module

Remove the ± 15 V module from the power supply assembly as follows, referring to Figure 11-6. Install by reversing removal procedures.

1. Remove power supply assembly from ventilator (Section 11.5).
2. Label and unsolder blue and brown wires of power supply ac harness from ± 15 V module transformer.

NOTE:

Replace fuse in In-line fuse holder (EMI 7200ae Ventilators only), as applicable.

3. Label and unsolder power supply dc harness from ± 15 V module circuit board.
4. Separate ± 15 V module from baseplate by removing four attaching screws.
5. If present, remove fuse replacement caution tag from ± 15 V module, and attach caution tag with a cable tie (P/N 4-000003-00) to new ± 15 V module.

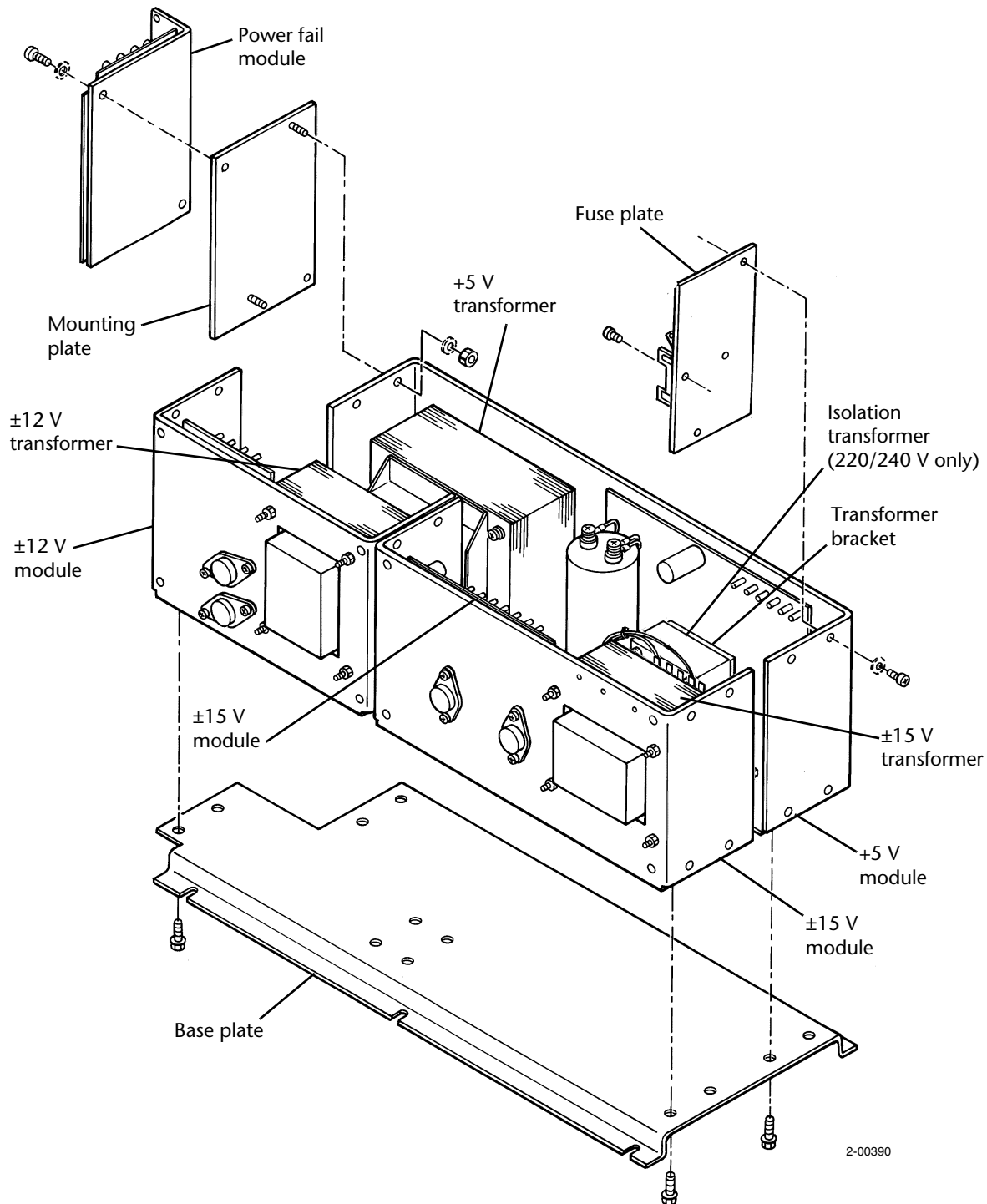


Figure 11-6. Removing Power Supply Modules

11.6.4 Power Fail Module

Remove the power fail module from the power supply assembly as follows, referring to Figure 11-6 and Figure 11-7. Install by reversing removal procedures.

1. Remove power supply assembly from ventilator (Section 11.2).
2. Label and remove blue and brown wires in power supply ac harness from power fail module transformer.

3. Label and remove black and white wires in power supply dc harness from power fail module circuit board.
4. Separate power fail module from +5 V module by removing two attaching screws and lockwashers.

11.6.5 Isolation Transformer (220/240 V Power Supply)

Remove the isolation transformer from the power supply as follows, referring to Figure 11-6 and Figure 11-7. Install by reversing removal procedures.

1. Remove power supply assembly from ventilator (Section 11.5).
2. Label and remove wires that connect isolation transformer to power supply.
3. Remove transformer bracket by removing two screws and two nuts.
4. Remove isolation transformer from transformer bracket by removing four nuts from studs of isolation transformer.

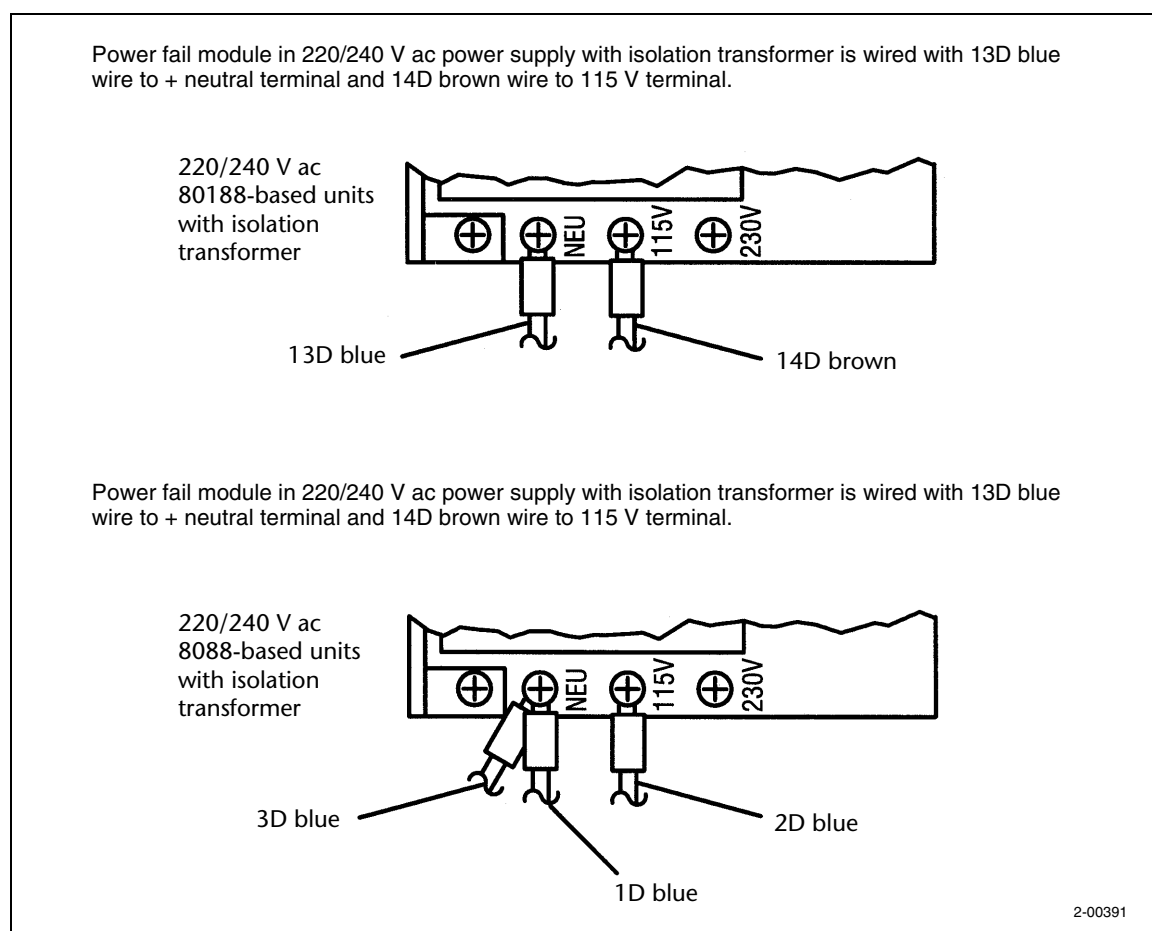


Figure 11-7. Isolation Transformer Terminal Connections

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Repair: Utility Panel Assembly

The utility panel distributes ac power from facility power outlets to the power supply and other ventilator components. In addition, the utility panel contains two rechargeable batteries to operate alarm functions and maintain ventilator data in memory during power interruption.

This section includes removal and installation procedures for the utility panel assembly. Before repairing the utility panel assembly, familiarize yourself with the warnings, cautions, and general repair instructions in Section 8.

Warning

To prevent personal injury and equipment or property damage, ensure that electrical power sources and pneumatic sources are disconnected from the ventilator before servicing.

NOTE:

Any time you disconnect the batteries, be sure to:

- Perform a monitor volume calibration before placing the monitor back into service (ventilators with 7250 Metabolic Monitors only). Refer to the *7250 Operator's Manual*.
 - Reset the time on the calendar-clock after the batteries are reconnected.
 - Delete 1401 error code from BBR.
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12.1 Removal/Installation of Utility Panel Assembly

Remove the utility panel assembly as follows. Install by reversing removal procedures.

1. Remove top cabinet panel and top cover, as applicable (Section 19.1.1), and back panel and inner back panel, as applicable (Section 19.2.1), and swing open left panel (Section 9.1).
2. Disconnect utility panel harness from J11 on motherboard.

NOTE:

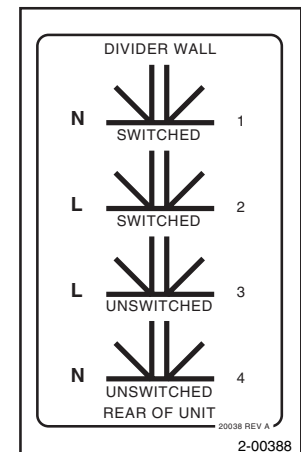
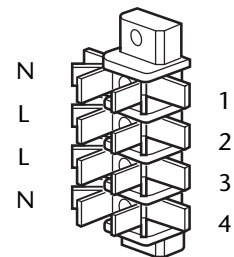
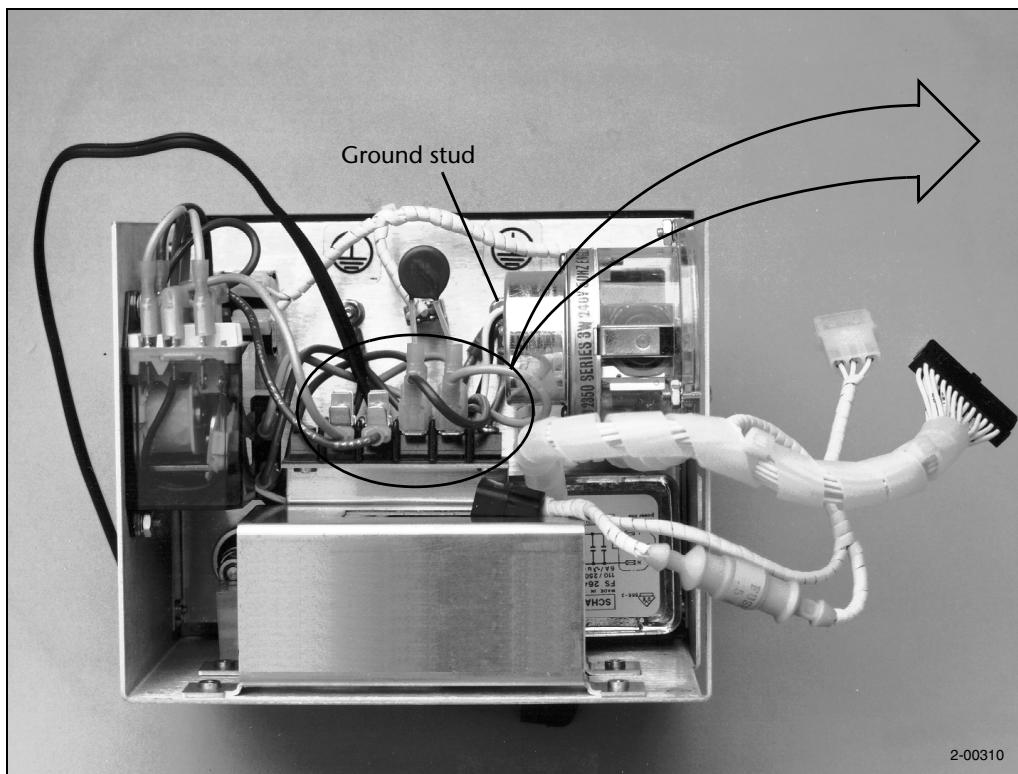
The locations of utility panel terminals are shown on the terminal block label on the ventilator cabinet divider wall.

3. If ventilator has a surge suppressor mounted near top of ventilator, disconnect these surge suppressor wires from utility panel terminal block (Figure 12-1 and Figure 12-3):
 - a. Blue wire from "N1" terminal.
 - b. Brown wire from "L2" terminal.

4. If ventilator does *not* have a surge suppressor mounted near top of ventilator, disconnect these ac harness wires from utility panel terminal block (Figure 12-1 and Figure 12-3):
 - a. Blue wire(s) from "N1" terminal.
 - b. Brown wire(s) from "L2" terminal.
5. Disconnect these humidifier outlet harness wires from utility panel terminal block:
 - a. Blue wire from "N1" terminal.
 - b. Brown wire from "L2" terminal.
6. Free these green or green/yellow ground wires from rear utility panel ground stud by removing nut and washer (Figure 12-1):
 - a. Humidifier outlet harness ground wire.
 - b. Console shield wire.
 - c. Surge suppressor ground wire (in 220/240 V units with top-mounted surge suppressors).

Caution

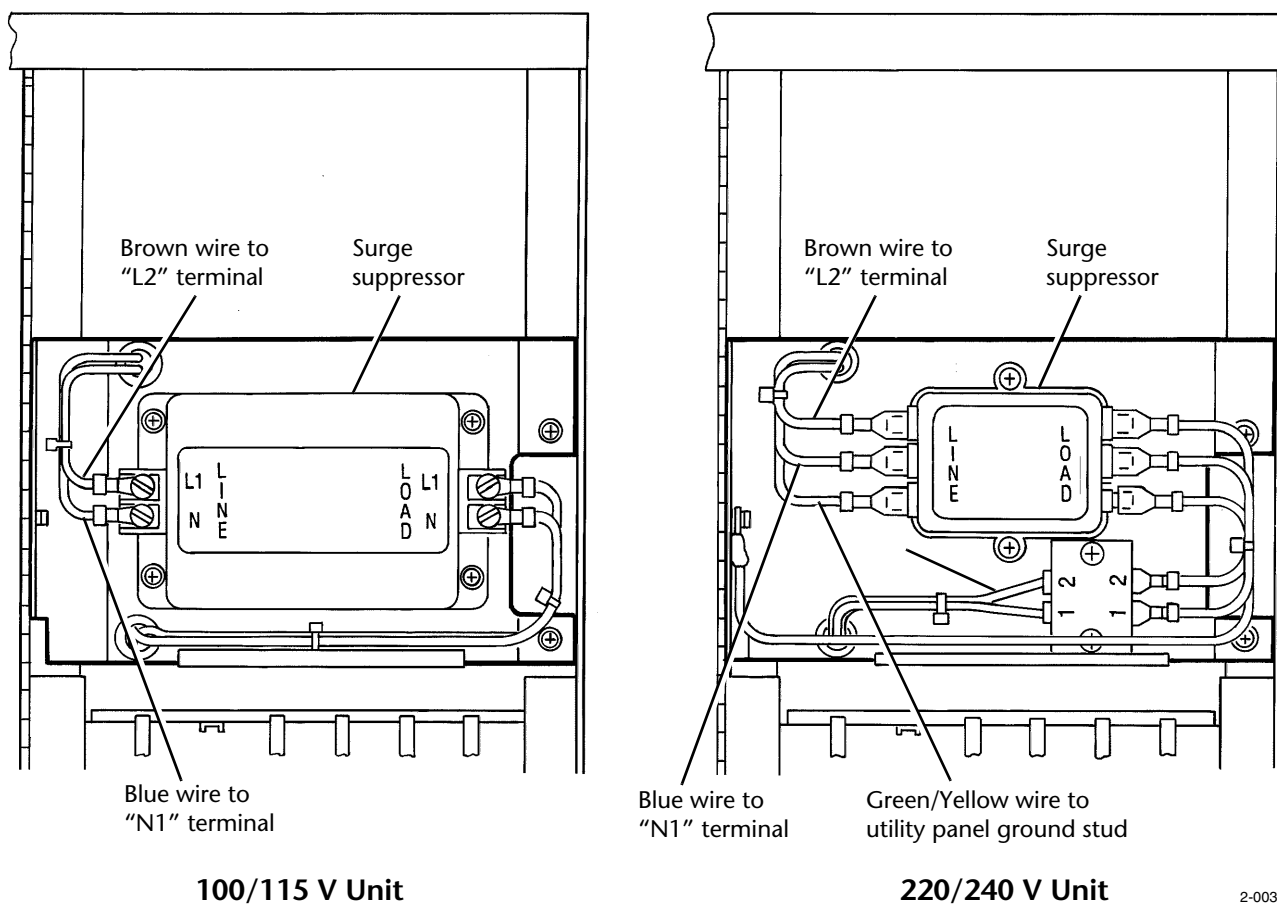
When removing or installing the battery tray, take care to prevent damage to the battery terminal wire insulation.



Terminal Block Label

Figure 12-1. Utility Panel Terminal Block

7. If ventilator has a compressor, disconnect compressor electrical circuit from utility panel as follows:
 - a. Remove compressor pedestal outer back panel by pulling out on upper corners of back panel until ball studs disengage from catches in compressor pedestal cabinet.
 - b. Remove inner back panel by removing 8 (later version) or 12 (earlier version) attaching screws and washers.
 - c. Disconnect utility panel harness receptacle from compressor harness connector, reaching into upper compressor compartment at back of compressor pedestal.
 - d. Push utility panel harness receptacle up through square hole at top of compressor pedestal and fully into utility panel.
 - e. Remove two screws that attach front of utility panel to ventilator. Remove cord bracket. Slide utility panel out left side of ventilator.
8. If ventilator does not have a compressor, remove two screws that attach front of utility panel, cover plate, and cord bracket to ventilator (Figure 12-3). Remove cord bracket and slide utility panel out of left side of ventilator.



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Figure 12-2. Disconnecting Top-Mounted Surge Suppressor Harness

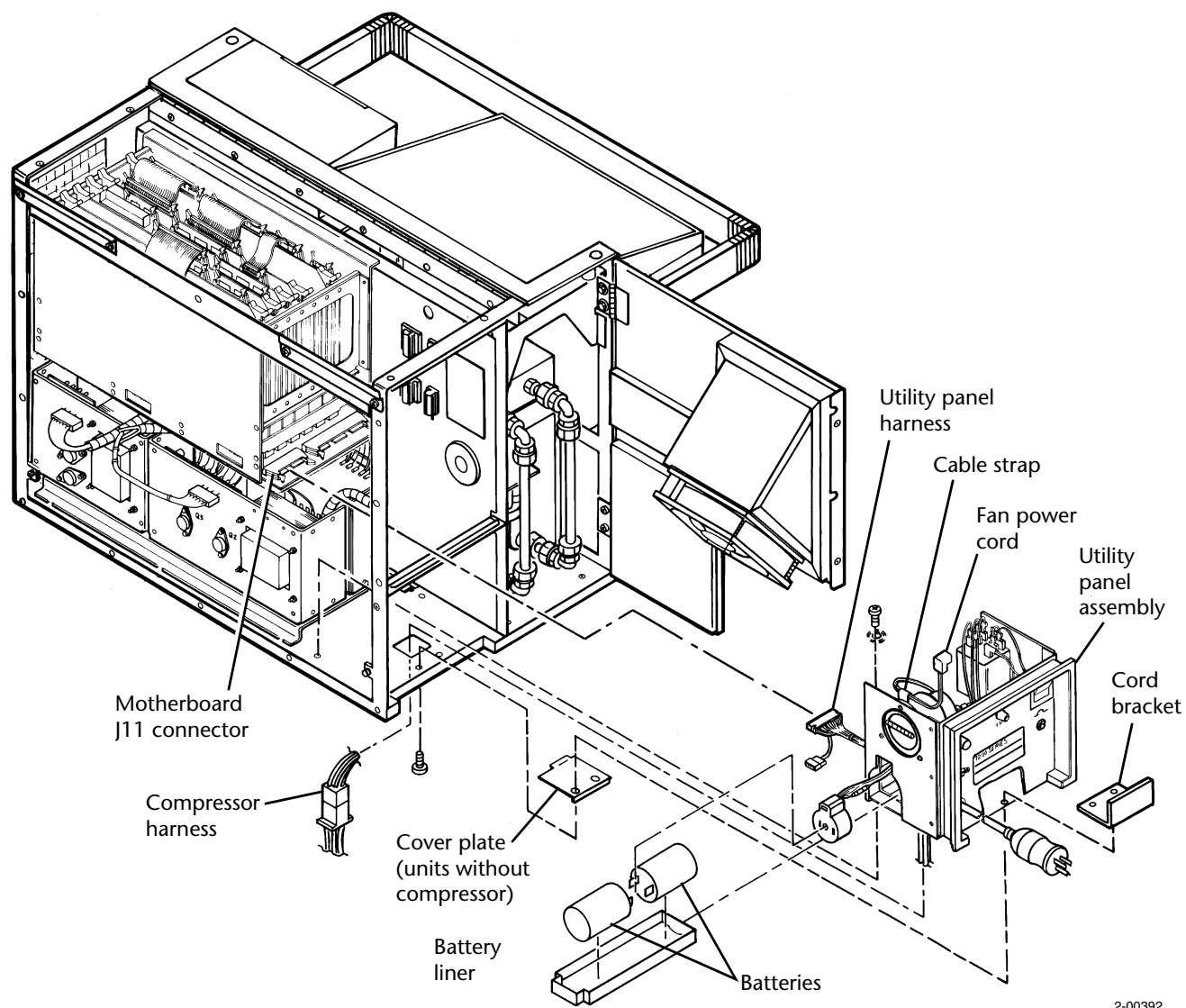


Figure 12-3. Removing Utility Panel Assembly

12.2 Power Switch

The power switch applies filtered ac to ventilator components. Replace the power switch every 10,000 hours of ventilator operation; it is part of the 10,000-hour preventive maintenance kit. Remove and install it as follows, referring to Figure 12-4.

1. Disconnect wires from power switch. Remove power switch by pressing top and bottom of switch while pushing out.
2. Install new switch and reconnect wires.
3. Test new switch:
 - a. Turn switch on to ensure power disconnect audible alarm functions. Power cord should *not* be connected to facility power.
 - b. Turn switch off.
 - c. Reconnect electrical power to ventilator.
 - d. Turn switch on and off to ensure it actuates freely, and ventilator runs POST.
 - e. Disconnect electrical power.

NOTE:

If new switch does not fit, you may need to file opening for switch. To do so, remove utility panel and use a metal file to lightly file right or left side only of aluminum plate opening. Use a piece of sandpaper to smooth rough edges. Carefully blow out filings from utility panel.

4. Reinstall utility panel in ventilator.

12.3 Ventilator Elapsed Time Meter

The ventilator elapsed time meter (ETM) measures the hours that the ventilator operates. A second elapsed time meter in the compressor compartment measures the hours the compressor operates (Section 16.7). Remove the ventilator elapsed time meter as follows, referring to Figure 12-4. Install by reversing removal procedures.

1. Disconnect wires from elapsed time meter.
2. Remove elapsed time meter by removing three attaching screws, lockwashers, and nuts.

12.4 Circuit Breaker

The circuit breaker protects the ventilator components from excessive current. Remove the circuit breaker as follows, referring to Figure 12-4. Install by reversing removal procedures.

1. Disconnect wires from circuit breaker.
2. Remove circuit breaker by removing attaching nut.

12.5 Power Line Filter

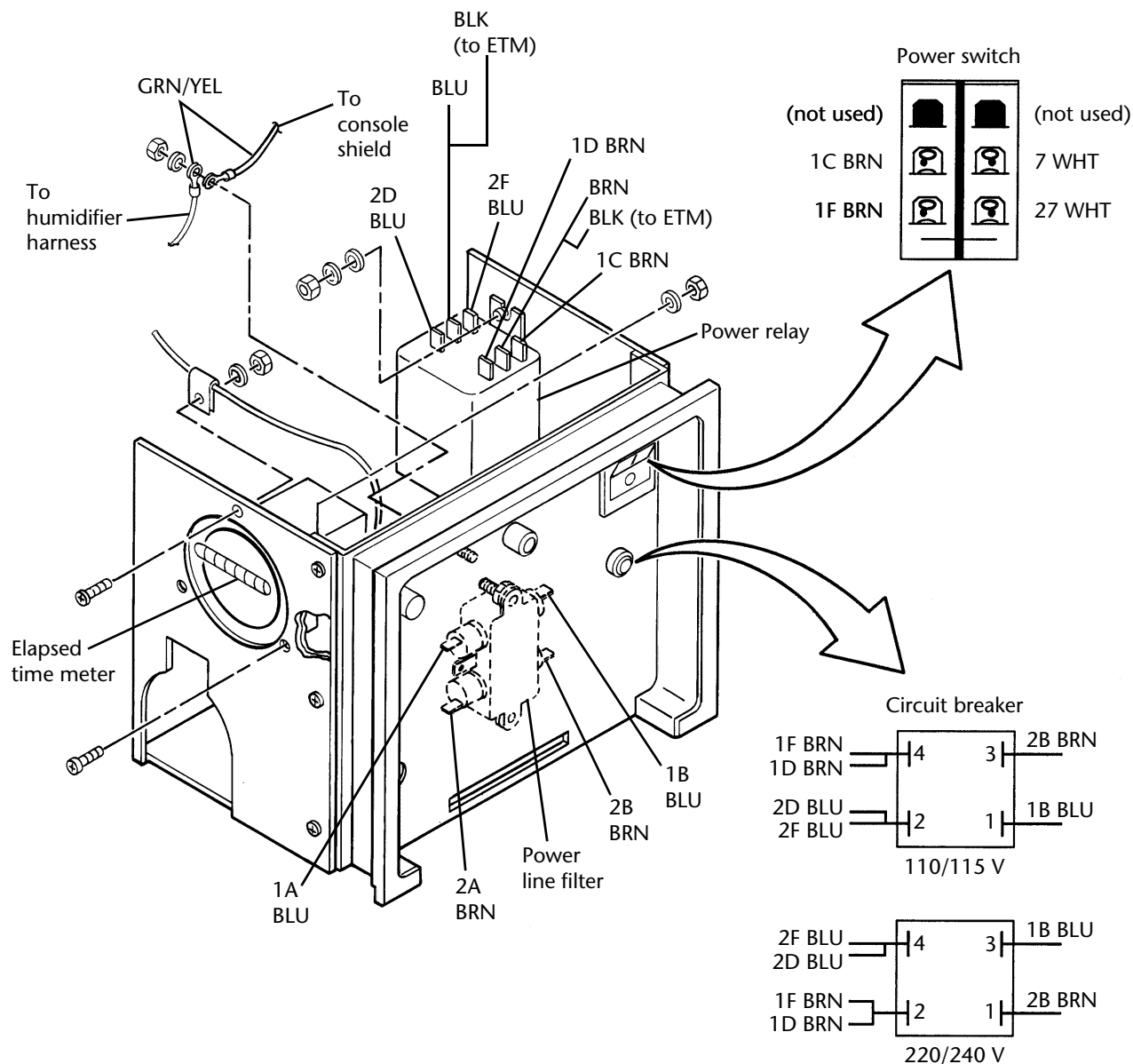
The power line filter filters ac power. Remove the power line filter as follows, referring to Figure 12-4. Install by reversing removal procedures.

1. Remove utility panel from ventilator (Section 12.1).
2. Disconnect wires from power line filter.
3. Remove power line filter by removing attaching nut and lockwashers from the two studs on utility panel cover.

12.6 Power Relay

The power relay applies ac power to ventilator components. Remove the power relay as follows, referring to Figure 12-4. Install by reversing removal procedures.

1. Remove utility panel from ventilator (Section 12.1).
2. Disconnect wires from power relay.
3. Remove power relay by removing two nuts, lockwashers, and washers.



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Figure 12-4. Removing Utility Panel Components

12.7 Utility Panel Harness

The utility panel harness interconnects the motherboard, the analog output connector, the batteries, the utility panel terminal block, the fan motion sensor alarm harness (if so equipped), the compressor compartment electronics, the alarm volume potentiometer (R1), and the EST switch. Later versions of this harness also include an In-line fuse. R1 and the EST switch are part of the harness.

12.7.1 Removal/Installation

Remove the utility panel harness as follows, referring to Figure 12-5. Install by reversing removal procedures.

1. Remove utility panel from ventilator (Section 12.1).
2. Remove batteries and battery liner by sliding them out from utility panel, then disconnecting batteries from battery connector.
3. Disconnect harness (two white wires) from power switch.
4. Free EST switch from utility panel by unscrewing dress nut, then removing nut and washers.

NOTE:

If it is necessary to use a tool to remove dress nut, cover nut with cloth to avoid scratching it.

5. Free audio alarm volume control from utility panel:
 - a. Using 0.050-in. hex driver, loosen setscrews in knob. Remove knob.
 - b. Remove nut and washers, and remove control from utility panel.
6. Free analog output connector from utility panel by removing two standoff posts and attaching hardware.
7. Disconnect harness from utility panel terminal block (Figure 12-1):
 - a. Disconnect blue wire from "N4" terminal.
 - b. Disconnect brown wire from "L3" terminal.

Caution

When installing the utility panel harness, be sure it is free and clear of the fan blades.

NOTE:

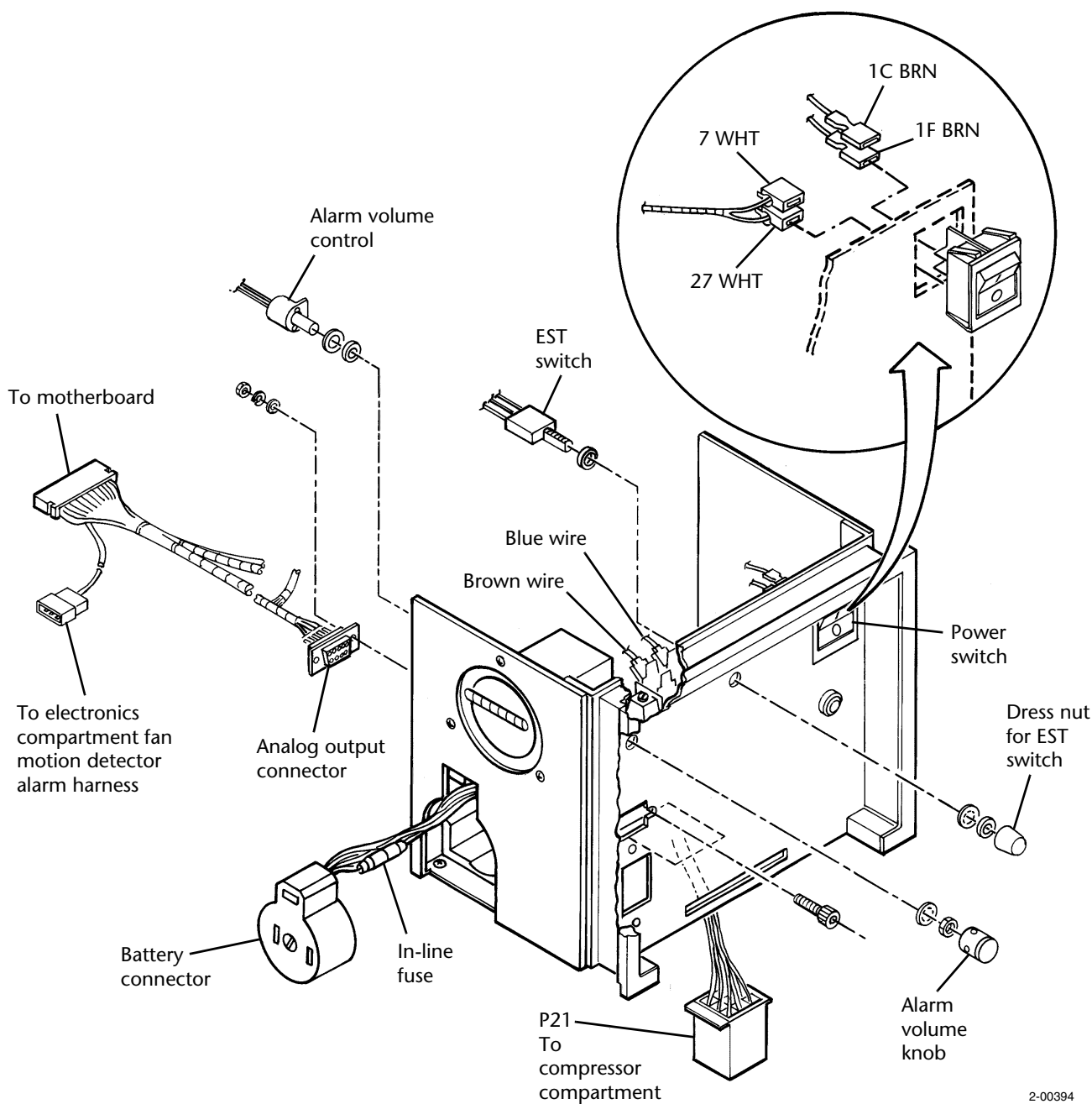
When installing a later-version harness in a ventilator without an active fan alarm, cover fan connector with insulating tape.

12.7.2 Fuse Replacement

Later versions of this harness include an In-line fuse, which is housed in a capsule molded into harness. To access fuse (Figure 12-5), pull ends of capsule apart. Replace fuse, as applicable.

Caution

When removing or installing the battery tray, take care to prevent damage to the battery terminal wire insulation.



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Figure 12-5. Removing Utility Panel Harness

12.8 220/240 V Line Voltage Filter Receptacle (Later Versions)

Follow these instructions to remove the 220/240 V line voltage filter receptacle (if so equipped), referring to Figure 12-6. Install by reversing removal procedures.

1. Remove utility panel from ventilator (Section 12.1).
2. Unplug ventilator power cord from face of utility panel.
3. Disconnect wires from line voltage filter receptacle.
4. Remove two screws holding power cord mount and line voltage filter receptacle in place. Remove line voltage filter receptacle.

12.9 Batteries

NOTE:

The batteries are now available only in a kit (P/N 4-021526-00), which includes two batteries and a return mailer. Always replace both batteries at the same time.

The batteries provide dc power backup to protect ventilator data and to activate the audio alarm if the facility power or ventilator internal electrical system fails. Replace the batteries every 10,000 hours of ventilator operation; they are part of the 10,000-hour preventive maintenance kit.

Remove the batteries as follows, referring to Figure 12-6. Install by reversing removal procedures:

1. Remove top cabinet panel and top cover, as applicable (Section 19.1.1), and back panel and inner back panel, as applicable (Section 19.2.1).

Caution

When removing or installing the battery tray, take care to prevent damage to the battery terminal wire insulation.

2. Remove batteries and battery liner by sliding them out from utility panel, then disconnecting batteries from battery connector.
3. Clean battery terminals, if oxidized.
4. If battery voltage is <2.0 V, replace both batteries.
5. Repackage used batteries (positive terminals taped) as the new batteries were packaged. Return them for recycling in mailer supplied (U.S.A. or Canada), or dispose of appropriately (outside U.S.A. and Canada).

Warning

To avoid accidental shorting and to prevent fire hazard, do not merely discard the batteries. Instead, repackage the used batteries in the same way the new batteries were packaged (positive terminals taped, terminals in foam). Recycle them or dispose of them appropriately.

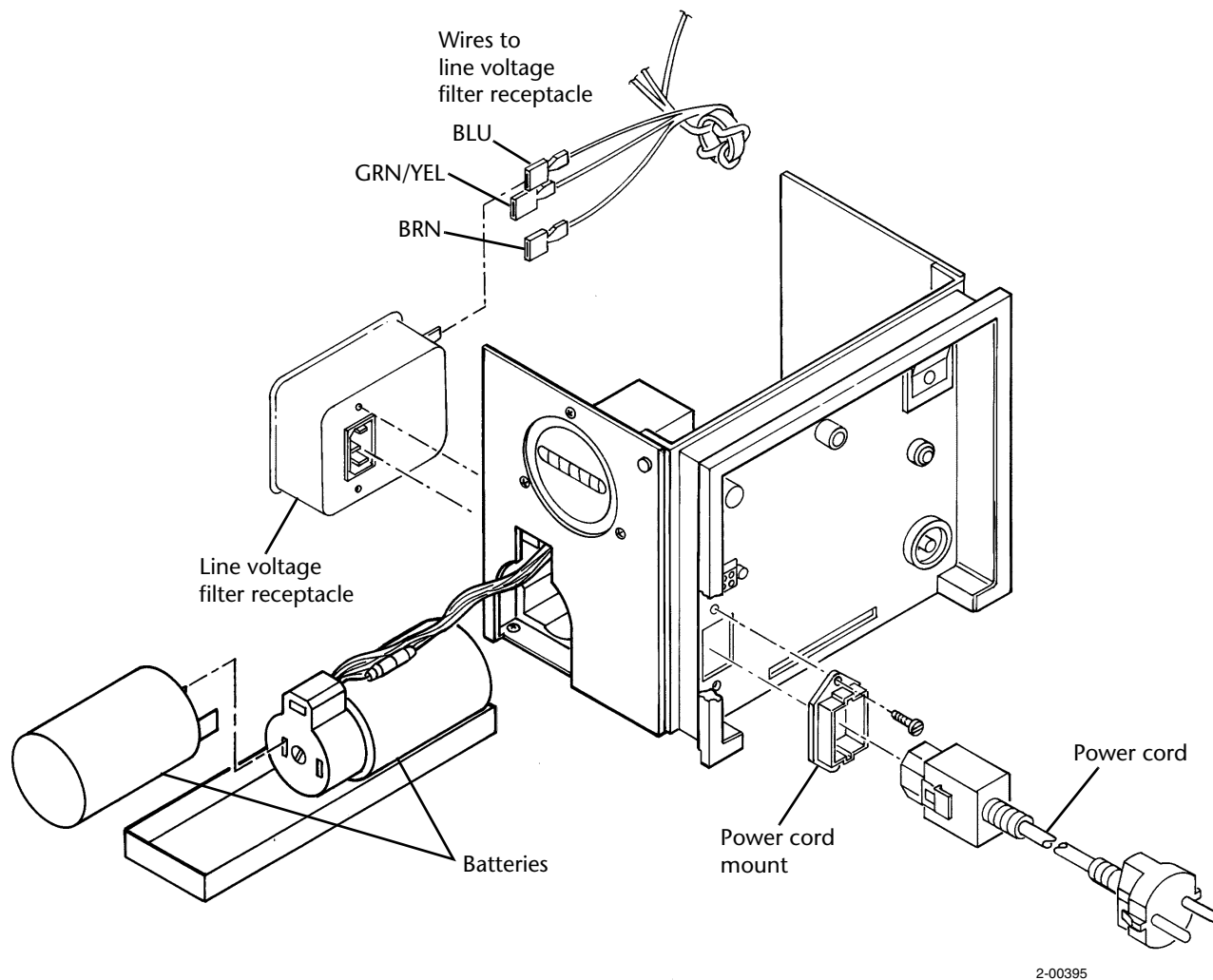


Figure 12-6. Removing Line Voltage Filter from 220/240 V Utility Panel